

**REMARKS:**

Applicant has carefully studied the final Examiner's Action and all references cited therein. The amendment appearing above and these explanatory remarks are believed to be fully responsive to the Action. Accordingly, this important patent application is now believed to be in condition for allowance.

Applicant responds to the outstanding Action by centered headings that correspond to the centered headings employed by the Office, to ensure full response on the merits to each finding of the Office.

**Claim Rejections – 35 U.S.C. § 103**

Applicant acknowledges the quotation of 35 U.S.C § 103(a).

Claims 1, 3-8, 12-14, 16, 17, 39 and 40-43 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Narang (US 6,991,876) in view of Okamura (US 5,476,730) and Momyer (US 4,001,043).

Claim 1 has been amended to more clearly describe that which the Applicant regards as the invention.

Independent claim 1 describes, "A non-air based electrochemical cell that releases energy upon the introduction of an aqueous activator to a solid alkali peroxide of a cathode of the cell, the electrochemical cell comprising: an aluminum anode; a first fiberglass cloth; an aqueous electrolyte solution positioned between the first fiberglass cloth and the aluminum anode; a cathode comprising a woven metal electrode and a solid alkali peroxide, the cathode positioned adjacent to the first fiberglass cloth, the woven metal electrode of the cathode positioned such that the first fiberglass cloth is between the woven metal electrode and the electrolyte solution and the solid alkali peroxide of the cathode positioned such that the woven metal electrode is between the solid alkali peroxide and the first fiberglass cloth, the aluminum anode and the cathode to participate in an electrochemical reaction to release energy from the cell upon the introduction of an aqueous activator".

As such, claim 1 describes a non-air based electrochemical cell that releases energy upon the introduction of an aqueous activator to a solid alkali peroxide of a cathode of the cell, further comprising an aluminum anode and an aqueous electrolyte.

The Office states, with respect to claim 1, that Narang teaches an electrochemical cell comprising an aluminum anode, a solid alkali metal peroxide cathode comprising sodium peroxide particulates and a separator comprising a fiberglass cloth between the anode and the cathode (Fig. 1; 4:7-10, 6:4-12, 8:1-8, Claim 1, Examples). The Office states that the cathode comprises a nickel current collector and the use of a glass woven separator between the anode and the cathode (Fig. 1; Examples) and that since aluminum is taught as the anode material and not an alloy of aluminum, the teaching is interpreted as being pure aluminum.

The Office goes on to state that Narang is silent to the arrangement of the components such that the cathode current collector is between the fiberglass cloth and the solid alkali peroxide, but that Okamura teaches an air cell having a configuration with an anode, glass separator, cathode current collector and cathode active material. The Office states that the cathode collector of Okamura is a metal mesh, the anode is aluminum, the separator is a glass cloth and the electrolyte is potassium chloride (Fig. 1; 2:1-40), and as such, Okamura teaches arranging the similar components in a different manner based on design choice.

Additionally, the Office concludes that it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the arrangement of components based on the design of the battery. The Office states that the two prior arts illustrate that the arrangement does not alter the operation of the battery and as such combining the battery components according to known designs would be obvious to one skilled in the art at the time of the invention because combining prior art elements according to known methods to yield predictable results and using known techniques to improve similar devices in the same way are considered obvious to one of ordinary skill in the art (KSR, MPEP 2141 (III)).

Applicant respectfully disagrees with the finding by the Office.

The Office states that in view of Narang and Okamura, “it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the

arrangement of components based on the desired design of the battery”, and that “the two prior arts illustrate that the arrangement does not alter the operation of the battery”.

Applicant disagrees with this statement by the Office. Clearly there are many electrochemical battery configurations known in the art. Narang teaches a metal/active oxygen battery that uses a non-aqueous electrolyte. Okamura teaches a metal/air cell that uses an aqueous electrolyte. While both types of batteries produce electricity by an electrochemical reaction, the chemical reactions taking place in the Narang cell are very different than the chemical reactions taking place in the Okamura cell. Narang teaches at col. 8, lines 49-56, using a non-aqueous electrolyte in order to avoid the parasitic reaction of lithium metal chemically reacting with water to liberate hydrogen. As such, the Narang cell teaches using a non-aqueous electrolyte to avoid an undesirable side effect. In contrast, Okamura teaches at col. 2, lines 34-42, an air cell that requires oxygen ( $O_2$ ) and water ( $H_2O$ ) to initiate the chemical reaction at the cathode. Clearly, the chemical reactions occurring in the Narang cell are not equivalent to the chemical reactions occurring in the Okamura cells. Accordingly, Applicant contends that it is not a matter of “design choice” to rearrange the components of Narang as suggested by Okamura because “design choices” for a metal/active oxygen/non-aqueous electrolyte cell would not be the same “design choices” for a metal/air/aqueous electrolyte cell. As such, Applicant contends that arrangement of the components *does* alter the operation of the battery depending upon the type of battery that is being designed and that the operation of the battery is indeed altered by the substitution or rearrangement of the components. The operation of the battery is altered because the battery no longer produces electricity using the same chemical reactions.

Additionally, it is the goal of battery research to increase energy density and efficiency of cells. Accordingly, one of ordinary skill in the art would be motivated to make “design choices” for batteries that would increase energy density and efficiency. The Office suggests that rearranging the components of Narang by placing the cathode collector between the fiberglass cloth and the solid alkali peroxide would be an obvious matter of design choice. Applicant disagrees with this conclusion by the Office.

Narang teaches achieving a higher efficiency by using a non-aqueous electrolyte and by avoiding the metal corrosion reaction at col. 8, lines 49-56. Placing the solid alkali peroxide

behind the cathode collector would increase the metal corrosion reaction which would be contradictory to the teaching of Narang and also contrary to what one of ordinary skill in the art would consider a “design choice” for the cell that would increase its energy density and efficiency. Applicant contends that design choices that would be considered by one of ordinary skill in the art would be design choices that would ultimately meet the goals of battery research and that rearranging the components of Narang as suggested by the Office would not meet the goals of battery research.

In addition, Narang states at column 2, lines 54-57, “Therefore, there is still a need to develop batteries that have a relatively high specific energy density, have high efficiencies, can be sealed, are intrinsically more stable, and are relatively safe to store and operate”. As such, Narang clearly describes the improvements needed in a “sealed” battery, not improvements needed in a metal-air battery that requires exposure to an oxygen source. Again, making the rearrangements as suggested by the Office would certainly alter the operation of the battery because one battery is sealed and the other battery requires an oxygen source to operation.

In support of the obviousness rejection, the Office states that “combining prior art elements according to known methods to yield predictable results and using known techniques to improve similar devices in the same way are considered obvious to one of ordinary skill in the art (KSR, MPEP 2141 (III))”.

Applicant contends that the cell of Narang and the cell of Okamura are not “similar devices”. These two types of cells produce electricity through very different chemical reactions. Also, the known techniques to improve a metal/air cell would not be the same known techniques to improve a metal/active oxygen cell.

The Office states on pg. 4 that, “Narang is silent to a silver mesh current collector and an aqueous electrolyte. Momyer teaches a metal-water electrochemical cell comprising a lithium anode, a silver current collector and an electrolyte comprising soluble peroxide ions, including hydrogen peroxide, sodium peroxide, sodium super oxide, lithium peroxide, potassium peroxide and potassium super oxide (Claims 1, 2; 4:59-68)”. Additionally, the Office states that, “Momyer teaches that it would be obvious to one skilled in the art to incorporate the same electrode configuration with an aqueous electrolyte. Combining prior art elements according to

known methods to yield predictable results and using known techniques to improve similar devices in the same way are considered obvious to one of ordinary skill in the art (KSR, MPEP 2141 (III))”.

Applicant respectfully disagrees that it would be obvious to substitute the electrolyte of Narang with an aqueous electrolyte as described by Momyer.

The Office states that Momyer teaches that it would be obvious to one skilled in the art to incorporate the same electrode configuration with an aqueous electrolyte. The Office has failed to show where Momyer teaches this substitution in the reference and Applicant disagrees with this statement by the Office.

The electrochemical cell of Narang is clearly described as having a non-aqueous electrolyte. Narang, throughout the specification and specifically at col. 2, lines 60-65, states that, “The present invention is directed to configurations and methods for a battery having a non-aqueous electrolyte, and in which an anode includes a metal, a cathode includes an active oxygen species, and wherein oxidation of the metal and reduction of the active oxygen species provides the current of the battery”. Additionally, Narang teaches at col. 8, lines 49-56, the advantage of using a non-aqueous electrolyte in order to avoid the parasitic reaction of lithium metal chemically reacting with water to liberate hydrogen. As such, the Narang cell teaches using a non-aqueous electrolyte to avoid an undesirable side effect. Therefore, the electrochemical cell of Narang is clearly described as being non-aqueous and it would not be considered obvious to one skilled in the art to incorporate the same electrode configuration with an aqueous electrolyte because the goal of one skilled in the art would be to improve the energy density and efficiency of the cell and making such a substitution would result in a lower energy density and less efficient cell. As such, making such a substitution would not improve the device as suggested by the Office.

For the reasons indicated above, Applicant believes that amended independent claim 1 is patentable over Narang in view of Okamura and Momyer and is believed to be in condition for allowance.

Claims 3-8, 12-14, 16, 17, 39, 40 and 43 are dependent upon claim 1, which has been shown to be allowable, and are therefore allowable as a matter of law.

Specifically regarding claims 16, 17 and 39, the Office states that the disclosure of Narang differs from Applicant's claim in the Narang does not specifically disclose the ratio of the electrode bulk surface area of the anode to the bulk surface area of the cathode, but that nevertheless, it is well known in that art that the optimal ratio is dependent upon physical configuration of the galvanic cell and the chemical reactions present. Therefore, the Office contends that it would have been within the skill of the ordinary artisan to adjust the ratio of the electrode bulk surface area of the anode to the electrode bulk surface area of the cathode in accordance to the configuration of the electrochemical and the kinetics of the reaction. The Office states that differences in prior art ranges are unpatentable unless they produce a new and unexpected result, which is different in kind and not merely in degree from the results of the prior art and that discovery of optimum ranges of a result effective variable in a known process is ordinarily within the skill of art and the selection of the optimum ranges within the general condition is obvious. (MPEP 2144.05)

Applicant contends that it would not be obvious to adjust the ratio of the area of the anode to the area of the cathode to be between about 23% and 40% as recited by claims 17 and 39 because the ratio claimed produces a new and unexpected result. It would be expected that the highest energy from the electrochemical cell would be realized if the anode area were large relative to the cathode area because this would provide a maximum amount of anode material for the chemical reaction to occur. However, as shown with reference to Fig. 3, the maximum energy rate for the cell of the present invention was observed for an anode to cathode area ratio of between 0.23 and 0.40. As such, Applicant contends that claims 17 and 39 are patentable over Narang because the range of the ratio of the electrode bulk surface area of the anode to the bulk surface area of the cathode of between 23% and 40% produces a new and unexpected result.

Claims 1, 3-5, 7-9, 12-14, 16, 17, 39, 40 and 43 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Schiffer (US 4,005,246) in view of Okamura (US 5,476,730) and Christian (7,045,252).

Regarding independent claim 1, the Office states that Schiffer teaches a reserve battery which comprises an aluminum anode, a cathode of silver oxide, a separator of fibrous material or paper and a potassium chloride electrolyte (Fig. 1; 2:45-65, 3:1-35). The battery is activated by adding water or other aqueous electrolyte to the battery (3:60-4:30). Since the anode is taught as being either aluminum or aluminum alloy, the recitation of aluminum is interpreted as being pure aluminum. The Office additionally states that it would be obvious to one skilled in the art to interpret the teaching of aluminum as pure since the prior art distinguishes between the pure metal and an alloy of the metal. The Office states that while Schiffer is silent to the cathode being sodium peroxide, that Christian teaches alkaline batteries with similar chemical characteristics. The Office states that Christian teaches cathode materials including silver oxide or peroxide salts such as sodium peroxide and the electrolyte is an aqueous solution of potassium hydroxide (Abstract, 3:15-20, 4:55-65) and that silver oxide and sodium peroxide are taught to be functionally equivalent soluble peroxides used as the same material in an electrochemical cell. The Office concludes that it would have been obvious to one of ordinary skill in the art at the time of the invention to substitute the silver oxide of Schiffer with the functional equivalent of sodium peroxide as taught by Christian. Additionally, the Office states that Schiffer is silent to a fiberglass cloth separator and a current collector between the fiberglass cloth and the solid alkali peroxide but that Okamura teaches an electrochemical cell with an aluminum anode and a separator made of fiberglass or paper (2:20-30). The fiberglass separator, as taught by Okamura, and paper separator, taught by Schiffer are shown as equivalent separators known in the art at the time of the invention

Applicant respectfully disagrees with the finding by the Office.

The Office states that “silver oxide and sodium peroxide are taught to be functionally equivalent soluble peroxides used as the same material in an electrochemical cell”. Applicant disagrees with the Office. While silver oxide and sodium peroxide can both be used as cathodes, in the most basic manner, one is an oxide and the other is a peroxide. An oxide contains oxygen with an oxidation state (OS) equal to -2, while a peroxide contains this material with an OS equal to -1. Generally, the oxidation state will dictate the behavior (or chemical pathways) of elements and ions in solution, and as such an oxide and a peroxide would not function equivalently in a chemical reaction of the electrochemical cell as suggested by the Office.

It could further be said that an oxide contains oxygen with an oxidation state (OS) of -2, while a peroxide contains this material with a n OS = -1. Generally, OS will contribute to dictating the behavior (or chemical pathways) of elements and ions in solution.

As such, Applicant contends that it would not have been obvious to one of ordinary skill in the art at the time of the invention to substitute the silver oxide of Schiffer with the sodium peroxide as taught by Christian because silver oxide and sodium peroxide are not functionally equivalent.

Regarding independent claim 1, for the reasons indicated above, Applicant contends that the Office has not established a *prima facie* case of obviousness because Schiffer in combination with Christian and Okamura do not teach every element in the claim.

Accordingly, Applicant contends that independent claim 1 is patentable over Schiffer in view of Christian and Okamura and is believed to be in condition for allowance.

Claims 3-5, 7-9, 12-14, 16, 17, 39, 40 and 43 are dependent upon claim 1, and are therefore allowable as a matter of law.

Specifically regarding claims 16, 17 and 39, the Office states that the disclosure of Schiffer does not specifically disclose the ratio of the electrode bulk surface area of the anode to the bulk surface area of the cathode, but that nevertheless, it is well known in that art that the optimal ratio is dependent upon physical configuration of the galvanic cell and the chemical reactions present. Therefore, the Office contends that it would have been within the skill of the ordinary artisan to adjust the ratio of the electrode bulk surface area of the anode to the electrode bulk surface area of the cathode in accordance to the configuration of the electrochemical and the kinetics of the reaction. The Office states that differences in prior art ranges are unpatentable unless they produce a new and unexpected result, which is different in kind and not merely in degree from the results of the prior art and that discovery of optimum ranges of a result effective variable in a known process is ordinarily within the skill of art and the selection of the optimum ranges within the general condition is obvious. (MPEP 2144.05)

Applicant contends that it would not be obvious to adjust the ratio of the area of the anode to the area of the cathode to be between about 23% and 40% as recited by claims 17 and 39 because the ratio claimed produces a new and unexpected result. It would be expected that the highest energy from the electrochemical cell would be realized if the anode area were large relative to the cathode area because this would provide a maximum amount of anode material for the chemical reaction to occur. However, as shown with reference to Fig. 3, the maximum energy rate for the cell of the present invention was observed for an anode to cathode area ratio of between 0.23 and 0.40. As such, Applicant contends that claims 17 and 39 are patentable over Schiffer because the range of the ratio of the electrode bulk surface area of the anode to the bulk surface area of the cathode of between 23% and 40% produces a new and unexpected result.

If the Office is not fully persuaded as to the merits of Applicant's position, or if an Examiner's Amendment would place the pending claims in condition for allowance, a telephone call to the undersigned at (813) 925-8505 is requested.

Very respectfully,



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**SIGNATURE OF PRACTITIONER**

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**(37 C.F.R. 2.190 (b))**

I HEREBY CERTIFY that this correspondence is being electronically transmitted to the Patent and Trademark Office through EFS Web on July 28, 2009.

Date: July 28, 2009

/jessica powell/  
Jessica Powell